(1) Given the following bit pattern: $(0100\ 0000\ 0010\ 1101\ 1111\ 1000\ 0100\ 1101)_{two}$
What decimal number does it represent? Assume that it is an IEEE 754 single precision floating point number. (10%)

(2) Show the minimal MIPS instruction sequence for a new instruction called *not* that takes the one's complement of a Source register and places it in a Destination register. Convert this instruction (accepted by the MIPS assembler): *not $s0, $s1*
(Hint: It can be done in one instruction if you use the new logical instructions.) (10%)

(3) Consider the following measurements made on a pair of SPARCstation 10s running Solaris 2.3, connected to two different types of networks, and using TCP/IP for communication:

Characteristic	Ethernet	ATM
Bandwidth from node to network	1.25 MB/sec	10 MB/sec
Interconnect latency	18 μs	42 μs
HW latency to/from network	5 μs	9 μs
SW overhead sending to network	198 μs	211 μs
SW overhead receiving from network	249 μs	356 μs

(HW: Hardware; SW: Software)
Find the host-to-host latency for a 250-byte message using each network. (20%)

(4) Suppose there are a processor running at 1.5G Hz and a hard disk. The hard disk has a transfer rate of 8 MB/sec and uses DMA. Assume that the initial setup of a DMA transfer takes 800 clock cycles for the processor, and assume the handling of the interrupt at DMA completion requires 400 clock cycles for the processor. If the average transfer from the disk is 16 KB, what fraction of this processor is consumed if the disk is actively transferring 100% of the time? Ignore any impact from bus contention between the processor and DMA controller. (10%)

(5) Shell is in fact a critical part for Unix operating system. It accepts a command string input from its command line, find the corresponding executable program, and spawn a process to execute the program. Please use the fork system in Unix and other related system calls if needed to write a pseudo code that emulates what the shell does. (15)

(背面仍有題目,請繼續作答)

(6) The critical section problem of two processes is solved as follows: (15)

Algorithm 1
repeat
while turn ≠ i **do** no-op;
critical section;
turn := j;
remainder section;
until false;

Algorithm 2
repeat
flag[i] := true;
while flag[j] **do** no-op;
critical section;
flag[i] := false;
remainder section;
until false;

Algorithm 2
repeat
flag[i] := true;
turn := j;
while (flag[j] **and** turn = j) **do** no-op;
critical section;
flag[i] := false;
remainder section;
until false;

Are the conditions **mutual exclusion**, **progress**, and **bounded waiting** satisfied? You must give detailed explanation.

(7) True/False questions for the virutal memory page replacement algorithms: (20)

1. Belady's anomaly indicates that for some page-replacement algorithms, the page-fault rate may decrease as the number of allocated memory frames increases.
2. Stack algorithms is a set of page-replacement algoritjms that may exhibit Belady's anomaly.
3. FIFO page replacement algoritms is known to have the Belady's anomaly.
4. Optimal page-replacement algorithm is not feasible because it requires future knowledge of the reference string.
5. Most of computer systems do not implement the true LRU page replacement algorithm because no sufficient hardware is supported.
6. Additional-reference-bits page replacement algorithm is an approximate LRU page-replacement algorithm.
7. Enhanced second-chance page replacement algorithm uses the reference bit and the modify bit as an ordered pair.
8. Clock algoritm uses a priority queue to implement the second-chance page replacement algorithm.
9. Thrashing is the condition that a process is spending more time on paging than executing.
10. Working set model can prohibit thrashing while keeping the degree of multiprogramming as low as possible.